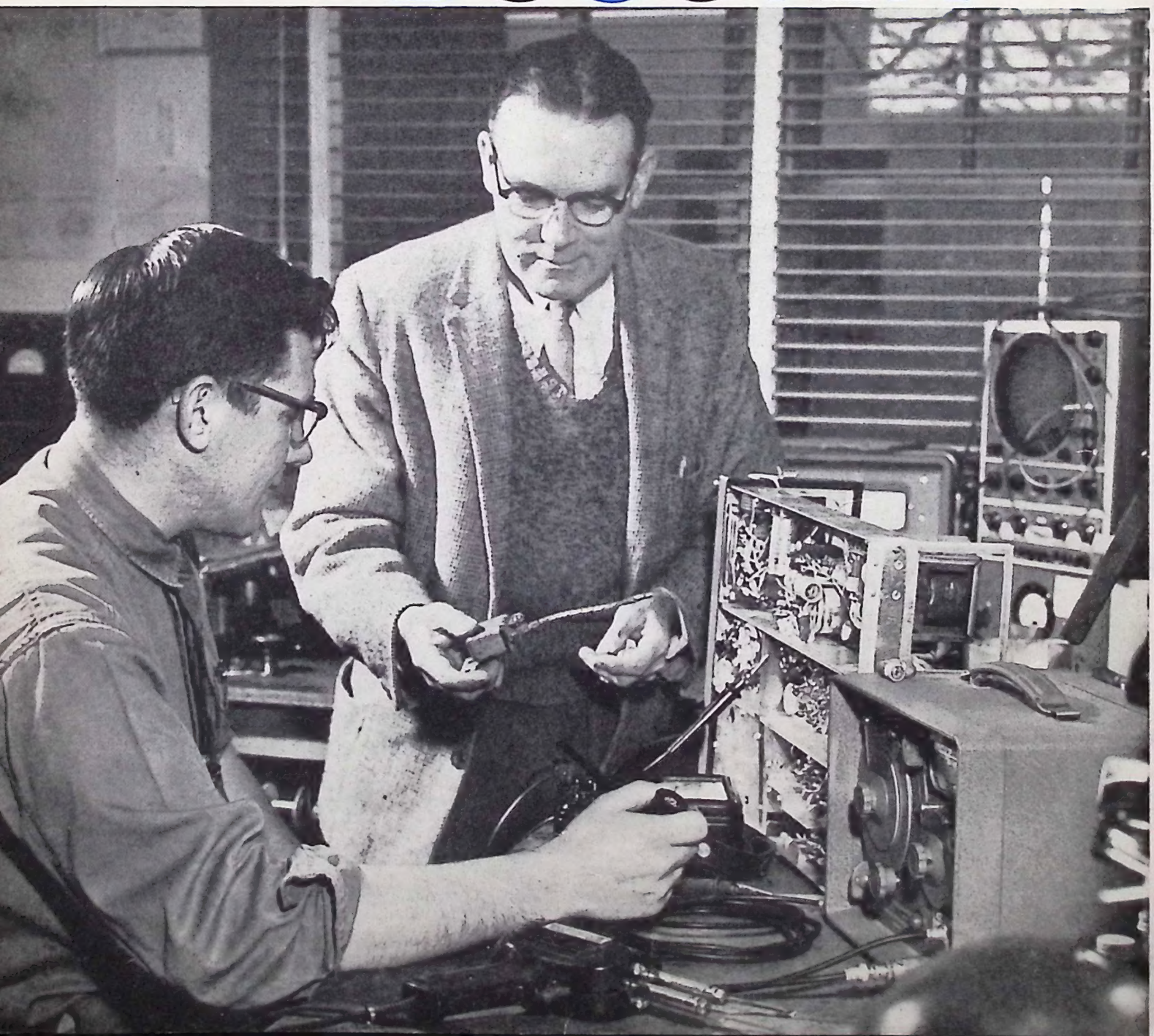
JAN. FEB. 1961

CONTENTS

COVER STORY	PAGE 2
TECHNICAL SECTION	PAGE 3
TIPS FOR TECHNICIANS	PAGE 5
INDUSTRY NEWS	PAGE 7
WHAT'S NEW	PAGE 8

A MAGAZINE DEVOTED TO THE INTERESTS OF RADIO, HI-FI AND TV TECHNICIANS IN CANADA

ROGERS BOOSTER



cover story

Electronics and logging don't at first glance seem to go together but British Columbia's huge logging industry has proved important to Ball and Shemilt Electronics Limited, of Victoria. The firm has supplied loggers with large orders and servicing for two-way radio communication equipment.

Ball and Shemilt, which has been in business, though not as a partnership for 40 years, is engaged in sales and service to television, radio, marine electronics, aircraft electronics and land mobile communications systems. The company also has an important mechanical shop.

Greater Victoria Police and Fire departments have communication systems maintained by Ball and Shemilt, and the company maintains two transmitting and receiving stations for local taxi firms on its premises, with land lines to their city offices.

It was in the spring of 1921 that John T. Ball laid the foundations of the company by opening an automotive electric service shop in Victoria. He also constructed some of the first radio receiving sets on the West coast. Then, in 1922 the company began selling one-tube radio receivers to the public.

In 1925 George, son of John T. Ball, joined the business. In those days it was conducted primarily as an electrical automobile repair shop and for radio construction and repairs. But by 1942 the Corporation of the District of Saanich was installing two-way F.M. radio in Police and Fire departments, an important development for B. and S.

During the war, from 1942 to 1945 the firm re-wound hundreds of small transformers, many of them for the department of National Defence. This was the only small transformer repair facility on Vancouver Island at the time.

In 1945 George Ball came into control of the business on the retirement of his father and started construction of a new building on the corner of Burnside and Harriet roads. Today, this building is still in use, though it has been further extended. In moving to the new premises the automotive electrical work was discontinued.

From 1948 to 1951 a new phase in operations grew up—radio and TV and appliance sales and service. In this George Ball was greatly helped by his wife Rose. And indicative of the firm's progressiveness, George built the first successful TV receiver in Victoria for reception of programs from KRSC in Seattle.

Howard Shemilt, now a partner in the business, started out as an employee in 1951. He had been a Petty Officer in the Royal Canadian Navy during the war. By 1955, Mr. Shemilt was taken in as a partner and, with electronics business rapidly growing in industry, the appliance repairs were discontinued.

Today, Ball and Shemilt, of Victoria, are still growing, and continue to serve the West Coast well.

technical section

Electrical Circuitry of the Signal-Seeking Tuner

In our last issue we discussed the overall operation and the mechanical details of the signal-seeking tuner. We should now turn our attention to the electrical portion of the device as shown in Figure 1.

Referring to Figure 1, the operation is as follows: (1) To start the tuner, the station selector bar is pressed momentarily. This actuates the station switch 24 which energizes the relay. (2) Contact #2 of this switch opens first, ungrounding the secondary of the output transformer and thus muting the radio before #1 closes. (3) Contact #1 closes and provides a circuit from B+ through the relay winding, resistor 23 and the station selector switch contact to ground.

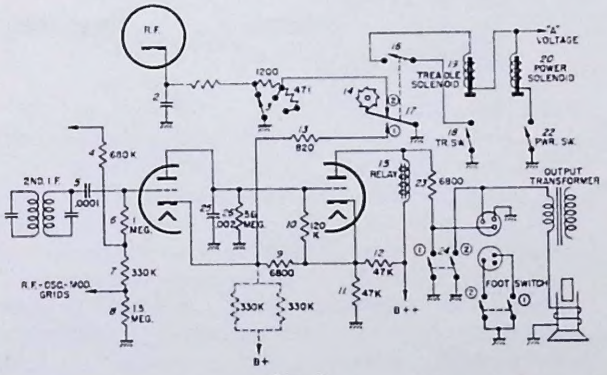


Fig. 1

(4) The current through this circuit energizes relay 15 and removes the relay arm from stopping disc 14. This starts the tuner, opens contact #2 and closes contact #1 on the relay switch 17. To keep the tuner seeking, after the selector bar is released, the relay is kept energized by a holding circuit.

(5) Since contact #2 of the relay switch is now open, the path to ground for the cathode of the r-f amplifier tube is through the sensitivity control 3 so the sensitivity of the radio can be controlled during the sweeping operation. (6) Relay switch contact #1 is grounded, thereby lowering the cathode-to-ground resistance of the relay section of the trigger tube by putting resistors 9 and 13 in parallel with cathode resistor 11. This reduces the cathode voltage and increases the plate current flowing in the trigger relay section. This is sufficient to keep the relay energized and the tuner seeking.

(6) To stop the tuner on a station, the relay is de-energized by an electronic triggering circuit actuated by the incoming signal, the latter developing a voltage in the primary and secondary of the second i-f transformer. The secondary voltage is coupled through capacitor 5 to the grid of the trigger detector section of the trigger tube. This voltage is developed across the resistor network 6, 7 & 8.

(7) The trigger detector section functions as a plate detector. The i-f voltage appears on the grid, the tube conducts and the i-f component is removed in the plate circuit by capacitor 25.

(8) The plate current in the trigger detector develops a biasing voltage across resistor 10 which is between grid and cathode of the relay section, thus making the grid more negative and reducing the plate current flowing in the relay winding. This reduced flow causes relay 15 to be de-energized and the relay arm again engages the stopping disc 14. This stops the tuner on the station, opens contact #1 and grounds #2 of the relay switch 17.

(9) To hold the tuner on the station until a change is desired, the relay is held de-energized until the starting circuit is actuated again by the operator. With switch contact #1 open, resistors 9 and 13 are no longer grounded, thus making the current flow in the relay negligible. With no current flowing in resistor 9, the voltage at the cathode of the trigger detector will go to about half the B+ value so that this triode cannot conduct until the relay is energized again. Relay switch contact #2 is grounded which grounds the 1200-ohm resistor in the sensitivity control 3, returning the radio to normal sensitivity.

The Foot Switch

To avoid the necessity for removing one hand from the steering wheel, a foot switch may be provided as shown in Figure 1. It is connected in parallel with (and its operation is essentially the same as) the station selector bar. When the foot switch is pressed, the speaker coil is shorted out so that the radio is muted while the B+ circuit is closed. Otherwise a "pop" would be heard when the B+ circuit was completed. The closing of contact #2 completes the B+ circuit through relay 15, through the foot switch to ground. This energizes the relay and the operation is then the same as previously outlined.

The Low-Voltage Tuner Circuit

The circuitry just discussed uses tubes requiring plate voltages running into the hundreds. More recent car receiver models use tubes that obtain their plate voltage supply from a 12-volt source. This calls for some minor modifications in the circuitry which are shown in Figure 2. One change that might be noted is that muting of the receiver is accomplished by grounding the first audio grid.

Operation of the circuit as a whole will be as previously described but keep Figure 2 in mind when tracing wiring.

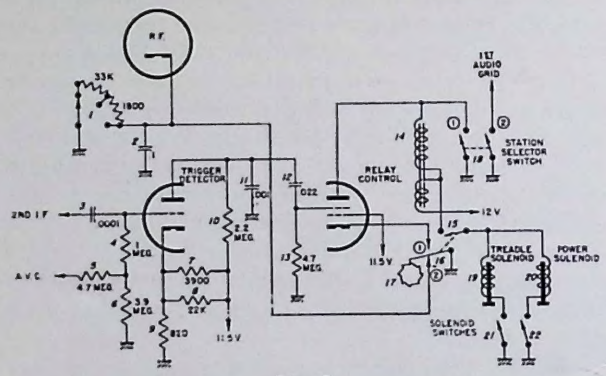


Fig. 2

Troubleshooting

When bench-testing a receiver of this kind, it is important that the source voltage be set high enough to ensure proper operation of the solenoids. Most battery eliminators do not have sufficient voltage regulation to hold 12 volts under the current drain of either or both of the solenoids. Consequently a 16-volt setting is required when using most eliminators.

The following list of typical symptoms and their causes should be helpful:

(1) Tuner stops at high end of dial: Treadle switch not closing, clutch disc loose on treadle shaft, clutch disc tightened in wrong position, defective treadle switch. Treadle contacts not closing on relay (see Figure 3). Oil on clutch disc.

TREADLE CONTACTS LISTENING POSITION (RELAY DE-ENERGIZED)
TREADLE CONTACTS SEEKING POSITION (RELAY ENERGIZED)
ARMATURE ARM
TREADLE CONTACTS

Fig. 3

(2) Tuner stops during return to low end: Low voltage, treadle solenoid "bottoms", strong signal de-energizes relay. (The latter is normal in strong-signal area. Check relay if tuner stops with antenna disconnected.)

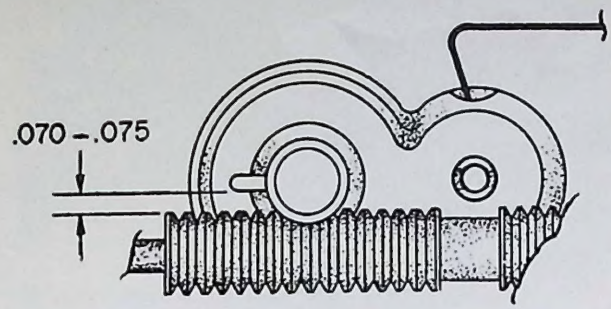


Fig. 4

(3) Tuner binds along dial: Treadle binding at pivots, treadle actuator lever binding on its shaft, pointer rubbing on dial back plate, bell crank bearing sticking, governor binding, rack worm unit binding on spline shaft or adjusted too tightly or loosely on flat gear. Governor adjusted too tightly or loosely on rack worm unit (see Figure 4). Broken power "ON" finger (see Figure 5).

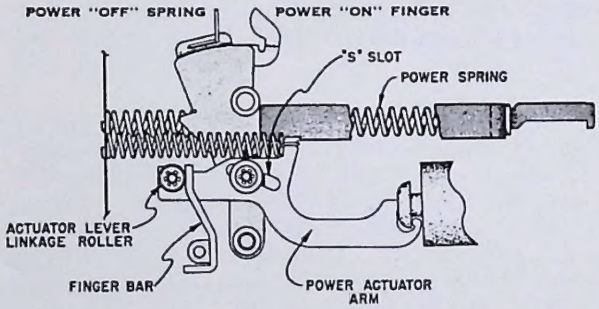


Fig. 5

(4) Tuner "machine guns": Governor gear train not adjusted (see Figure 4). Governor gear train defective.

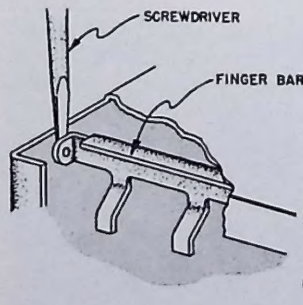


Fig. 6

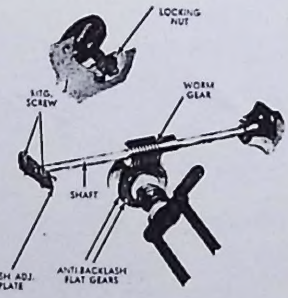


Fig. 7

(5) Manual tuning will not operate: Slipping clutch, stripped flat gear, loose spline on manual shaft, flat gear loose on bushing. Sticking finger bar. (See Figure 6. Pry end plates away at finger

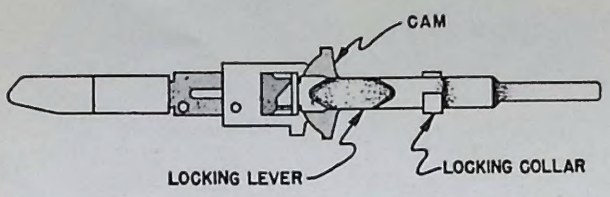


Fig. 8

bar pivots). Sticking solenoid, jammed "S" slot in actuator arm linkage (see Figure 5). Finger bar return spring missing, oil on clutch.

(6) Play in manual control: (See Figure 7) Broken or missing spring in anti-backlash gear, gear not wound tightly or pointer mechanism binding.

(7) Tuner will not operate by pushbutton: Broken locking lever cam or collar. (See Figure 8).

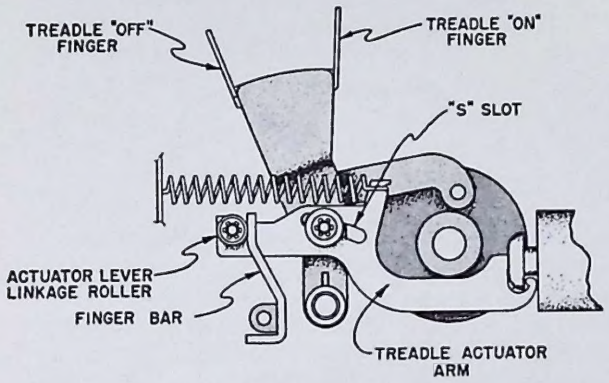


Fig. 9

(8) Tuner will not operate by any method: Broken treadle, core bars or connecting link.

(9) Tuner blows fuses: Sticking solenoids, clutch too tight, jammed "S" slot in actuator arms (See Figure 9), actuator lever linkage roller on wrong side of finger bar, treadle switch "off" finger by-passes switch, "off" finger broken, power switch "off" finger broken or by-passes switch (See Figure 10), sticking finger bar (see Figure 5), broken clutch lever arm, either solenoid "bottoms".

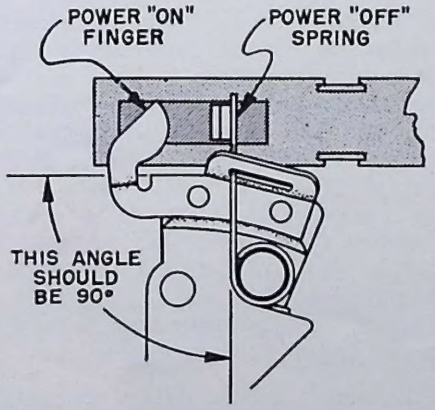


Fig. 10

for technicians

Test Lead Breakage—When "Quick Clips" are used on TV leads and jumpers, the wires break off quite frequently. They last much longer if the flat lead is taped to one backwing of the clip. This is a time-saver in the shop or in service in the home.

ERNEST A. BIMM, Pembroke, Ont.

★ ★ ★

Soldering Technique—I always keep a number of small squares of asbestos paper (the furnace-pipe type) on the bench. These are handy when soldering in the chassis, especially in confined spaces. They are folded around the contact to be soldered and so protect adjacent wiring from accidental contact with the iron and also prevent damage to other components. The asbestos also catches accidental solder drippings which would fall into the chassis and cause further trouble.

J. T. FREEMAN, Vancouver, B.C.

★ ★ ★

Cleaning Gang Condenser—A scratching or static sound heard when the tuning dial of a radio is rotated, indicates that the gang condenser is in need of cleaning. This sometimes produces a difficult problem since simply oiling or brushing between the plates usually does not remedy the situation. As a result, many gang condensers are needlessly replaced. However, the following method will always give excellent results by burning away any dust, dirt, or foreign matter between the plates.

To clean the gang, simply rotate the shaft while power is applied in series with a light bulb, which acts as a load in case of a direct short between plates. Care must be exercised in this process since 110 volts AC is applied to the condenser, but it results in a perfectly clean, static free gang condenser.

BRIAN M. HOFSTETTER, Kitchener, Ont.

technical section *(continued)*

Limiting Resistors in Industrial Electronics

Industrial electronics is a rapidly expanding field and was one of the subjects suggested by our readers for inclusion in the Booster. Obviously, it is too lengthly a subject to be covered in one or two articles and it seemed to us that, from the viewpoint of the technician already experienced in radio and TV, the best approach would be to discuss circuit peculiarities and differences before going into a detailed discussion of any specific layout of equipment.

Thus, last month we dealt with the transient capacitor. In this issue we will consider the grid limiting resistor.

What is an Anode?

To the radio and TV technician the term "anode" usually refers to the plate since it is commonly the most positive element in vacuum tube circuitry. But this is not always the case and a grid may well be called an anode if it is made more positive than the cathode so that electrons flow to it.

Grid current flow is not new to us since it is taken advantage of in developing bias and in various limiter circuits. But, in the circuits we usually deal with, such currents are not great enough to damage the tube.

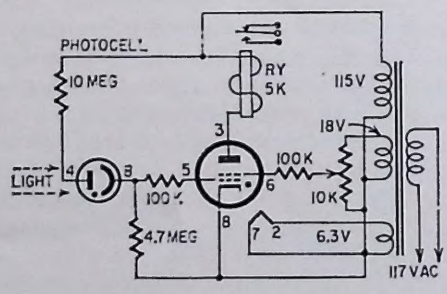


Fig. 1

Industrial Controls

Industrial controls, however, often employ thyratrons, the grids of which are connected to sources that can supply considerable current. If enough current is allowed to pass, the tube may destroy itself. An example is the thyratron 2050 which will pass a continuous current of 100 ma. but both the control and second (shield) grids must be limited to 10 or 15 ma.

A Typical Example

Figure 1 shows a photocell and thyratron circuit in which the grid current must be kept under control. A negative bias on the shield grid blocks conduction in the tube unless the phototube conducts and allows the control grid to go positive. (The phototube will conduct when light strikes it.) Since the anode or plate is supplied with 60 cycle ac, it is only necessary to make the shield grid negative when the anode is positive because the tube will not fire on negative half cycles. Through a separate winding on the transformer, the ac on the shield grid is 180 degrees out-of-phase with that on the anode. Thus, half the time the shield is negative and conduction cannot occur but the other half of the time it is positive and that is when excessive grid current may flow.

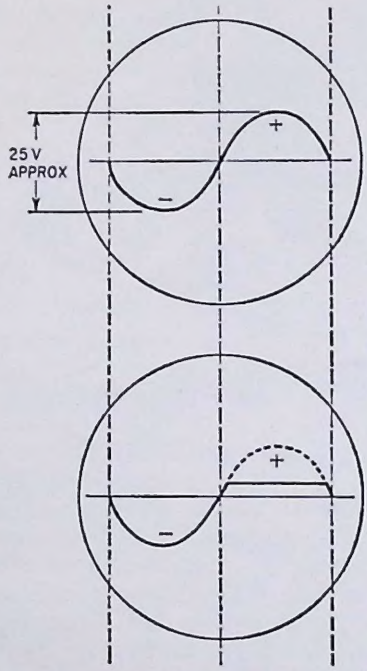
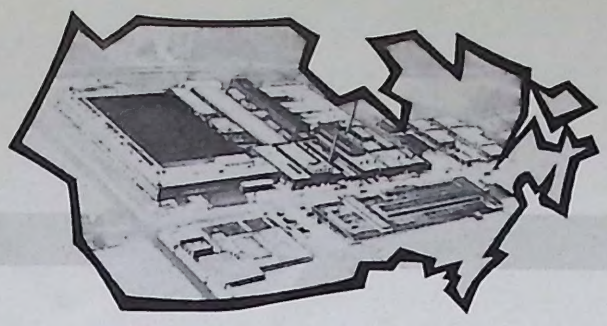


Fig. 2

However this flow can be kept under control with a series-limiting resistor as shown in Figure 1. The value is by no means critical and anything from 20 to 100 k may be used. The tube will supply itself with a pulsating dc negative bias because conduction only occurs during half of each cycle.

Figure 2 shows the waveforms involved. The upper curve is the waveform of the voltage supplied to the shield grid and the lower curve shows the actual voltage appearing because of the drop in the series-limiting resistor.

The foregoing is one very simple application but similar grid-limiting resistors will be found throughout circuits employing thyratrons.



industry news

Radio Pioneer Dies—John V. L. Hogan, 71, radio pioneer and inventor, died at his home December 29th after a long illness. Mr. Hogan, a laboratory assistant to Dr. Lee de Forest in 1906-7, was a founder and a Fellow of the Institute of Radio Engineers. He was the holder of numerous patents, including the single-control tuner and received a Medal of Liberation from King Christian X of Denmark, as well as the Armstrong Medal, awards from the Radio Club of America and a Medal of Honor from the IRE.

Small Japanese Motors—Yashawa Electric Company, of Tokyo, is planning to produce printed motors under license from a French organization. Actual production will begin some time this year.

Rebuilding Color TV Tubes—While this may not yet be important to the Canadian technician, an American firm is supplying "Package Plant" equipment to picture tube rebuilders. They claim the small rebuilder can remake a 21" color tube at a cost of $14.00. Firms already rebuilding color tubes report that the tube's life appears to be shorter than black-and-white tubes.

Transistorized TV Postponed—Toshiba of Tokyo has decided to postpone indefinitely the full-scale sale of transistorized portable television sets on both domestic and export markets. The decision is based on skepticism as to the marketability of such small television sets with only an 8" screen. On the other hand, Sony Corp. says that its plan to offer similar sets for export this year is unchanged. The latter are the receivers that have been advertised as available from Canadian distributors in the very near future.

Canada Asks for Defence Role Step-up—Canada's electronics industry has branded its part in the development of Canadian-American defence production sharing as disappointing, slow and unsatisfactory. The EIA has presented a brief to Prime Minister Diefenbaker calling for a clear understanding with U.S. military authorities for an equitable sharing of technical development and production.

A New High in Oscillators—Fundamental oscillations at frequencies up to 103 kmc have been obtained from Esaki tunnel diodes in simple waveguide circuits according to the Bell Telephone Laboratories. The diodes were of the formed point contact variety and were constructed from n-type gallium arsenide.

Voltage Booster—A device which incorporates the planar design and combines two identical transistors was introduced recently in the U.S. The transistor, which will be ready for delivery in two months, is capable of boosting ten-fold the voltage of a standard automobile battery. The device will be offered initially as a d-c chopper amplifier, priced at $25 each (in lots of 1000 or more).

N.Y. Crash Radios Being Tested—Two radio receivers from the ill-fated United Airlines DC-8 which crashed into a Brooklyn street December 16 have been shipped to Collins Radio for testing. The test will try to determine frequency settings of the portable receivers and whether or not they were operative at the moment the plane collided with a TWA Super Constellation. The report will be made to the Civil Aeronautics Board currently holding hearings on the crash.

Transistor Radios OK'd by Airline—Trans-Canada Airline has officially stated that passengers may continue to play their transistorized radios during flights despite a suggestion that such a unit may have been a factor in a recent airline disaster over New York. So far there are no facts to back up the theory that such a radio caused the American disaster but if any proof is uncovered the TCA will then ban the pocket radios.

Backdoor Tube Shipments—The charge that certain Canadian companies are attempting to circumvent the voluntary quota imposed by the Japanese government on electronic tubes by backdoor shipments to San Francisco or Seattle has been raised in parliament and is under government investigation. A letter received from a Japanese firm allegedly says that certain Canadian importers were negotiating with Japanese manufacturers for the tubes to be shipped first into the United States and then trans-shipped into Canada.

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what's NEW?

in semi-conductors, tubes and components

The M8096 V.H.F. Power Tetrode

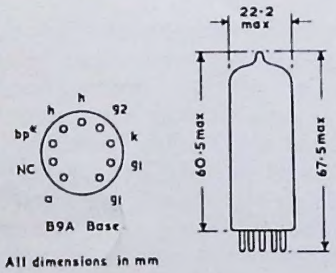
The enormous extension of the application of electron tubes in wired and mobile communications has created a requirement for tubes of special features to ensure dependable operation.

These tubes are referred to as Special Quality ("S.Q.") tubes. The initial cost of S.Q. tubes is higher but experience has proven that it is more than compensated for by the resulting greater reliability, controlled characteristics during life, and lower maintenance cost of the equipment.

One such tube is the Special Quality M8096 r.f. beam power tetrode for use at frequencies up to 175 Mc/s. The M8096, a direct plug-in replacement for the 5763/QV03-12, is designed to give maximum reliability in equipment when mechanical vibration and shocks are unavoidable and where statistically controlled major electrical characteristics are required.

Typical Operating Characteristics:

Plate Voltage	250 volts
Grid #2 Voltage	250 volts
Grid #1 Voltage	-7.5 volts
Plate Current	45 mA
Grid #2 Current	4.5 mA
Transconductance	7000 micromhos
Gain $G_1 - G_2$	16



Rogers 6HG8/ECF86 and 7HG8/PCF86

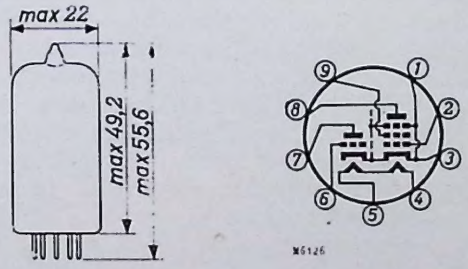
The Rogers 6HG8/ECF86 and 7HG8/PCF86 are triode-pentodes of advanced design for use in the mixer stage of V.H.F. tuners in television receivers. Both tubes use the frame-grid construction for the control grid and in so doing achieve a very high transconductance (12,000 micromhos) in the pentode section in class A conditions.

The precise engineering of the frame grid construction makes possible the mass production of high gain tubes with small and closely controlled cathode-to-grid No. 1 spacing. The frame grid method of manufacture also permits the use of extremely fine grid wires, wound to a higher t.p.i. (turns per inch) than has been previously possible. The small distance thus obtained results in the tube having a very high slope and a low equivalent noise resistance. In a TV receiver this means that the picture shows far less "snow" and a higher sensitivity level is achieved.

In the design of the 6HG8/ECF86 and 7HG8/PCF86, special attention has been paid to high frequency performance. Two connections are made to the pentode cathode to give minimum lead inductance, and a small screen grid compensating inductance is built into the tube which becomes effective at the higher frequencies.

Typical Operating Conditions (in mixer stage)

	Pentode	Triode
Plate Voltage	190 V	190 V
Screen Voltage	190 V	
Screen Grid Series Resistor	18 K ohms	
Control Grid Circuit Resistance	100 K ohms	
Oscillator Voltage	2.3 V r.m.s.	4.5 V r.m.s.
Plate Current	8.5 mA	12 mA
Screen Grid Current	2.8 mA	
Control Grid Current	30 uA	450 uA
Conversion Transconductance	4500 micromhos	
Transconductance		3500 micromhos
Plate Resistance	0.6 megohms	
Plate Load Resistance		10 K ohms



Electrode connections and dimensions (in mm) Base: Noval

Published by Rogers Electronic Tubes & Components, a Division of Philips Electronics Industries Ltd., 116 Vanderhoof Ave., Toronto 17, Ontario.